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Introduction

Community studies of smoking cessation and prevention are defined as research in which geographically defined populations or age cohorts are selected for experimental intervention or as control or comparison groups. In this chapter, four major studies of cessation are described, and related research findings are briefly considered. Three major studies of prevention are also reviewed, with less extensive presentations of other recent research. The theoretical background for these studies is outlined, methodological issues are discussed, and directions for future research are suggested. It is concluded that community studies represent a significant emerging paradigm for public health research.

The first public health "revolution," the recently achieved control of major infectious disease, evolved in two phases: (1) recognition that certain aspects of the environment are associated with disease, and (2) establishment of sanitation facilities and services, such as refuse collection and plumbing systems, for entire communities of people. Basic public health engineering that was revolutionary a century ago is now taken for granted by society. Today we emphasize the second public health "revolution," the current efforts to control chronic disease through behavior change. This development has also evolved in two stages: (1) recognition of behaviors, such as cigarette smoking, as being associated with disease, and (2) development of new services to change those behaviors (Wynder and Hoffman 1979). As might be expected, this most recent history of public health is no less turbulent than that which preceded it.

Various factors have hindered progress. After the basic causes of smoking-related diseases were recognized, there has been a tendency to invest scarce resources in increasingly intricate studies of disease causation processes. In addition, once funding is secured for intervention to reduce smoking, efforts often focus on individual-level, clinically oriented interventions (Lichtenstein 1982). If these interventions do not succeed, society is inclined to "blame the victim," much as the poor were held responsible for the microbes in their water by 19th century social conservatives. The socioeconomic gradient in rates of smoking and smoking-related disease may also slow society's response at a community level to this modern, noncommunicable disease epidemic. The greatest factor inhibiting progress, however, is the cost of prevention. Such costs are compounded by political obstacles stemming from the tremendous influence of the tobacco industry, which employs thousands of people and regularly delivers a substantial portion of tax revenues (Breslow 1982; Fritschler 1975; Sapolsky 1980). On a national scale, dramatic changes in tobacco consumption have occurred in response to successive measures (Warner 1977; Warner and Murt 1982), but these have been limited largely to higher income groups. Few

examples of bold community or regional efforts comparable to those involved in the control of infectious disease have been witnessed, and the prevalence of smoking has declined much less dramatically among women and has even increased in some minorities.

Characteristics of a Controlled Community Study

For this discussion, a controlled community study is defined according to the scope of intervention and quality of research design, with the essential feature being identification of natural, location-based aggregations of individuals as well as formal and informal social systems. In a community study, the entire population of a geographic area is considered, so that a church or worksite is not a community itself, but one of many systems constituting the total network of interactions. The term "community" originally referred to small systems numbering no more than several thousand persons. This discussion, however, includes research on towns, counties, or other relatively independent zones with up to several hundred thousand inhabitants. Because educational systems represent all age cohorts of youth, school-based studies are also reported. Studies of entire States or nations are only briefly considered.

Because the population size to be addressed is a limiting factor in any social program, the large numbers of people involved in a community study dictate selection of intervention methods. Clinical or other people-oriented approaches that typify behavioral research on smoking cessation and prevention (Bernstein 1969; Bernstein and McAlister 1976; Pechacek and McAlister 1980; Lando and McGovern 1982; Lichtenstein 1982) are not feasible for programs directed toward many thousands of people. Community studies instead emphasize large-scale delivery systems such as the mass communication media. Because community participation is now considered essential for success, such studies also include community organization programs seeking to stimulate interpersonal communication in ways that are feasible on a large-scale basis. Community studies also may involve environmental change, such as programs to modify the purchase price or availability of consumer products or to sanction public behaviors.

Because the emphasis herein is on controlled community research, attention is limited to studies in which valid inferences can be made concerning the effects of intervention on smoking rates in an entire population. The essential elements are use of adequate measures of smoking behavior applied over time in order to estimate long-term trends, and equally important, the inclusion of control or reference areas for the purpose of comparison. There are, of course, many questions and controversies regarding the usefulness and validity of large-scale experimental or quasi-experimental research (Campbell

and Cook 1979). Social policies such as those needed to sharply reduce smoking are not likely to be introduced without experimental trials, however, and the studies reported herein probably represent the best currently attainable compromise between external and internal validity. Given the very small number of studies meeting even the minimal methodological criteria, it would be unwise to restrict this review to the standards required by laboratory or clinical studies.

Theoretical Background

Effective mass communication, community organization, and environmental change require a theoretical basis for planning. Most community studies of health promotion and disease prevention are based on fundamental theories and concepts from the behavioral sciences. The most important of these are briefly outlined below.

Mass Communication

Theories on mass media effect have changed during the recent history of communication research, and several clear stages have been identified (Klapper 1960; Griffiths and Knutson 1960; Atkin 1979; Flay et al. 1980; Wallack 1981). Media were initially considered nearly omnipotent in directly altering behavior, but it was later discovered that they are incapable of producing effects independent of other, more powerful social forces. The most recent view is that mass media may have effects, but that they are small and largely dependent on facilitation from interpersonal influences and favorable environmental circumstances. Notwithstanding these limitations, shifts of a few percentage points in consumer preferences may be very significant in product marketing, while similar reductions in chronic disease-promoting behaviors may have enormous absolute significance in a population of several millions. One mass media effect that is agreed upon by most communication scientists is termed the "agenda-setting function" (McCombs and Shaw 1972), in which the media powerfully influence topics generated in formal and informal social gatherings. Media communication can also inform and teach simple skills (Bandura 1977). But the manner in which people actually behave with regard to a particular topic of discussion, and whether or not information or skills are actually used, depends more upon interpersonal forces than upon the media messages themselves.

Community Organization

The theories and concepts that underlie community organization are less well developed than those applied to media planning. Although there is broad agreement that the effects of the media are

enhanced by interpersonal factors, there is no clear consensus on the exact identity of these factors or how they can be feasibly modified in entire communities. A useful principle is derived from Bandura's (1977) distinction between factors influencing acquisition of new behaviors and those influencing performance of new behaviors. Media communications can model new behaviors so that they are learned (acquired) on a cognitive level (the person knows how to perform the behavior). However, cueing and feedback (direct social reinforcement) are usually needed for behavioral learning, or actual performance of the new behavior. Numerous studies of learning via media communication show that when a complex behavior is being learned, effectiveness is sharply enhanced by providing supplementary interpersonal communication for encouragement, feedback, and reinforcement (Bandura 1977). To create feedback and reinforcement in a community setting, organizations must be involved to provide roles and structure for interpersonal communication. Where formal social networks are not involved, communication and influence will be diffused through families and other informal systems (Meyer et al. 1977). The effectiveness of interpersonal communication can be greatly enhanced, however, by organizing formal or semiformal structures, such as learning groups using leaders trained to lead discussions, answer questions, and provide encouragement and followup. Various campaigns in agricultural development illustrate these principles (Green 1970; Rogers and Shoemaker 1971).

A related factor is the notion of generalized social support (Caplan et al. 1975), which refers not to the differential social reinforcement of specific behaviors, but to the general extent and quality of interpersonal relationships. Social relations appear to be generally helpful, probably because of their "stress-buffering" effects. Social ties within the family probably enhance cessation and prevention of tobacco use. For example, spousal support leads to higher successful quit rates (West et al. 1977; Mermelstein et al. 1983), and lower rates of teenage smoking occur in families in which neither parent smokes (National Institute on Education 1979). The general enhancement of interpersonal support networks is, of course, a primary objective of religious groups and social work and most other helping professions.

Environmental Change

There are also theories and concepts from which environmental changes can be planned (Bandura 1977; Craik 1973), the basic principle of which is to modify the availability and cost of products or behaviors (such as by limiting supply or prohibiting behaviors in public settings). Not all such measures can be applied by communities as defined herein. For example, regulations on mass media advertising can probably be controlled in most cases only at the Federal level, although billboard advertising may be amenable to

more local control. Other promising interventions such as taxation (Lewit et al. 1981; Fugle 1980) can be applied within fairly small localities, but the risk of "black market" competition is lessened when economic controls are fairly uniform across larger geographic units. Product availability and regulation of behavior can be achieved by towns or countries, but restrictive regulations almost invariably arouse opposition unless the public is willing to self-enforce the restrictions. Therefore, it is legitimate to favor voluntary restraints over those that require formal policing. Syme and Alcala (1982) call for intervention and prevention efforts at the community level using a public education agenda. Such programs will seek to increase public awareness of the health consequences of smoking, create an atmosphere in which smoking is recognized as a minority behavior, influence public policy, and increase antismoking advertisements.

Breslow (1982) has recently reviewed the environmental and public policy approaches to smoking control and calls for a "comprehensive strategy that will mobilize all available resources most effectively" (p. 149). He advocates Federal, State, and local legislation as the most important forms of social action directed toward action alternatives as well as research. He states that "protection and advancement of economic interests will generally follow prevailing ideology. Finding ways of cutting through the economic barriers, as always, will pose a challenge to public health. While compromises will be necessary, the objective of steady movement toward the goal now seems attainable" (p. 149).

Cessation Studies

Controlled community studies on smoking cessation are still relatively scarce. However, community trials for cardiovascular disease prevention, in which cigarette smoking is the major risk factor, are providing some of the best examples of research in this area. These studies have tended to focus on cessation among adults because primary outcomes of the trials include possible short-term (5- to 10-year) effects on cardiovascular mortality and morbidity rates that could hypothetically result from widespread adult cessation. These studies were reviewed in depth in the 1983 Report of the Surgeon General *The Health Consequences of Smoking* (USDHHS 1983).

Stanford Three-Community Study

The most well known U.S. cardiovascular community study was conducted in California by Farquhar, Maccoby, and colleagues at Stanford University (Farquhar et al. 1977; Maccoby and Alexander 1980; Meyer et al. 1980). Beginning in 1972 and ending in 1976, the

study was supported through the National Institutes of Health research grant program and involved three small communities (population of each was approximately 20,000) nonrandomly assigned to control, media-only, or media and face-to-face programs. The three towns are all within 100 miles of Stanford University. The control town, Tracy, is located in an inner valley and not exposed to media sources common to the other two towns, Gilroy and Watsonville. Gilroy, assigned to the media-only condition, is situated in a coastal valley, and Watsonville, receiving a small additional interpersonal communication program, is on the coast. In Watsonville, a cardiovascular high risk group including many smokers ($n=169$) was identified, and 113 cases were randomly assigned at a 2:1 ratio for face-to-face intervention. The three towns are demographically similar, although the proximity of Watsonville and Gilroy to the larger cities of Santa Cruz and San Jose gives them more cosmopolitan features than Tracy. Nevertheless, the research design was probably the best balance of feasibility and external and internal validity that could have been achieved in that setting given the limited available resources.

In each town, multistage probability samples of households were contacted and invited to a survey station where questionnaires and physiological measures were administered. These surveys were applied in the autumn months, beginning in Watsonville in September and ending in Tracy in November. Approximately 600 persons aged 35 to 59 were sampled at each location. The measurements included questions about smoking, and serum samples from high risk participants were analyzed to estimate thiocyanate concentrations as a check on inaccurate reporting of smoking status (Meyer et al. 1980). These measurements were taken annually for 4 years, yielding a picture of 3-year smoking trends among the survey participants in the three communities.

The program of media communication was conducted over 3 years (1973 to 1975), with greatest intensity in the first and second years of work. Television, newspapers, radio, billboards, and direct mail advertising were designed to provide information and to model attitudes and skills that would promote behavioral changes associated with lowered cardiovascular risk, such as weight reduction, lowered fat consumption, and increased exercise. To encourage cessation of smoking, information about its harmful effects was given, along with advice on how to stop smoking. In booklets mailed to the sampled households in Gilroy and Watsonville, instructions were provided for simple self-control skills (Meyer et al. 1980). In brief television and radio communications, actors were shown recommending or modeling cessation of smoking in a variety of authoritative and entertaining ways.

The face-to-face, intensive instruction program was provided for 113 randomly assigned high risk participants in Watsonville, of whom 107 started treatment, and 77 continued for the second annual examination. Activities were based on principles of behavioral psychology and group dynamics and were designed to reinforce and train skills for behavior change (Meyer et al. 1980). The first-year program consisted of classes and home visits, mostly during the summer of 1973. During the summer of the following year, aggressive followup activities were conducted to reinforce smokers who reported cessation and to encourage and train those who were not yet able to quit. This maintenance program included training in stress management and other intensive, individual counseling for those who consented to continuing contact. In the third year, the activities were gradually reduced to telephone contacts and a small "reunion" in the summer of 1975.

The results of the program among high risk participants in each of the four surveys are displayed in Figure 1. Over the 3 years of study, the prevalence of smoking decreased markedly among the group receiving media and face-to-face communication. The group receiving media intervention showed an initial decline as compared with the control group, but the change did not differ from the modest reduction observed in Tracy over the entire 3-year period. Because the high risk samples included most of the older smokers in the survey samples from each community, the data on cessation in the complete samples corresponded closely to that of the high risk group. The serum thiocyanate tests indicated very slight overreporting of cessation (Farquhar et al. 1977), but self-reported cessation rates were not adjusted for thiocyanate findings (Kasl 1980). There was some attrition in this longitudinal study, but not enough to account for the clear differences in cessation rates between the intensively instructed and the other participants. Adjusting for attrition, 32 percent reported sustained cessation in the intensive intervention group (Meyer et al. 1980). This research supports the hypothesis that face-to-face communication is a necessary part of a successful community program to reduce smoking. Farquhar and his colleagues (Farquhar et al. 1981) conclude that the question of how such communication can be feasibly and cost-effectively provided on a widespread basis remains to be answered by further studies, and this conclusion will be noted in a later section. A number of critical comments can be made in regard to the Stanford three-community study, and these have been thoroughly discussed in numerous publications (Leventhal and Cleary 1980; Meyer et al. 1980). The primary shortcomings concern the quasi-experimental research design and the inability to generalize from the longitudinally followed study group to the entire community.

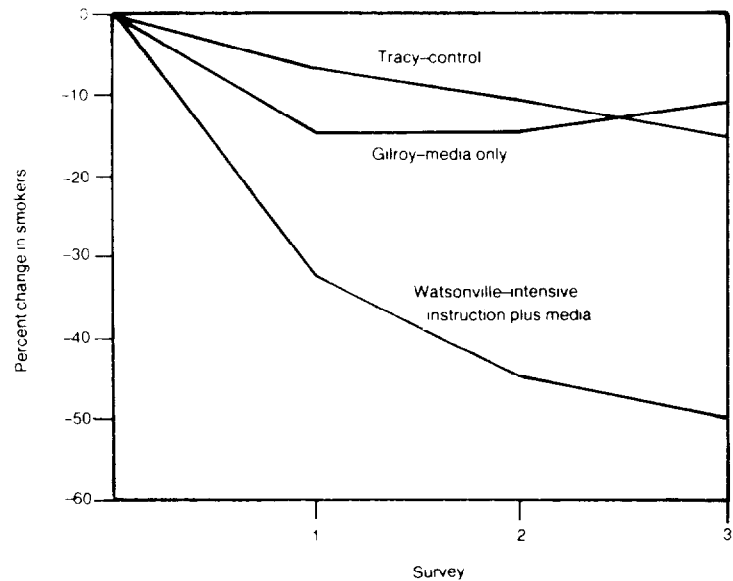


FIGURE 1.—Comparison of cessation rates among smokers in communities subjected to varied intensities of education, the Stanford three-community study

SOURCE: Farquhar et al. (1981).

Australian North Coast Program

A trial very similar to the Stanford three-community study was conducted by the regional Health Department of New South Wales, Australia (Egger et al. 1983), beginning in 1978 and, as in the Stanford study, using small community populations of 12,000 to 27,000 persons. The towns of Tamworth, Coff's Harbor, and Lismore were assigned to one of three conditions: control, media only, or combined media and community programs. The three towns were all between 300 and 400 miles from the research center in Sydney. Coff's Harbor, the media-only town, was approximately half the size of the other two communities. Tamworth was not served by the regional administrative center in Sydney.

In each town, a series of random sample surveys was conducted. Interviews and physiological examinations were requested from up to two adults in randomly sampled households. Those who refused appointments were given self-report questionnaires to be completed at home. Separate samples were drawn in 1978, 1980, and 1981 with the objective of measuring 600, 1,200, and 1,200 different persons in the 3 respective years. Smoking behavior, attitudes, and knowledge

regarding smoking were measured, and in 1980 and 1981, serum thiocyanate values were determined for a randomly selected 5 percent subsample. Measures were also made of other cardiovascular disease risk factors in accordance with the program's primary goal.

The media program included output from a television station, a radio station, and several small newspapers, supplemented by other materials such as stickers, posters, T-shirts, and balloons. The three stages of the media campaign were designed to sequentially raise awareness, provide information, and stimulate action. Advertising time was purchased to insure presentation of television commercials during peak viewing periods. Beginning in October 1979, the print advertisements were suspended for several months because of a complaint to the Media Council of Australia. The overall campaign continued for approximately 1 year. The community program that was applied in Lismore was varied. Several different kinds of groups, clinics, workshops, and other interpersonal support systems were organized; physicians were also involved. A total of 386 smokers participated in these activities, most (150) joining a 1-day workshop. The 3-month success rate in smoking cessation, measured by telephone interview, was 16 percent for the workshop participants. The highest success rate (48 percent) was found for the 40 persons who received help kits from physicians. The community program also included other programs (e.g., for physical fitness and stress management), which may have facilitated the cessation of smoking.

The results of the project were based on the three independent sample surveys. The authors point out that "there was substantial confounding owing to age and sex differences between towns" (p. 1127). Analyzing results according to a multiple logistic model controlling for age and sex differences, a significant treatment effect ($p=0.05$) was observed. Thiocyanate analyses showed no difference between towns in the small estimated invalidity of self-reports (3 percent). Among men and women in various age groups, consistently different rates of change in prevalence of smoking were found. In Lismore, absolute percentage reductions ranged from 6 to 15 percent. In the media-only town (Coff's Harbor) absolute 6 to 11 percent reductions were estimated. In Tamworth (the control) absolute reductions of only 2 to 5 percent were found. The researchers found no evidence of effects on knowledge or attitudes.

Many criticisms can be made from the standpoint of a clinical scientist accustomed to dealing with individual subjects in highly controlled settings. If limitations to inference are clearly acknowledged, however, the Australian study provides a practical illustration of what may be achieved through community intervention. The findings are based on independent samples, and thus represent changes that seem to have occurred on a communitywide basis. The magnitude of the apparent effect was particularly encouraging

among the youngest age groups (18 to 25) where absolute reductions in prevalence of smoking showed a threefold difference between the maximum intervention (15.6 percent) and control towns (5.0 percent). The most significant limitation arises out of the nonrandom assignment of communities and problems with their comparability.

Swiss National Research Program

Another important community study was conducted in Switzerland (Autorengruppe Nationales Forschungsprogramm 1984; Gutzwiller and Schweizer 1983). Four communities of 12,000 to 16,000 inhabitants were selected, two each from the German-speaking and the French-speaking parts of the country. A fifth community in the Italian-speaking region was also studied, but only for epidemiological purposes. French-speaking and German-speaking pairs were randomly assigned to intervention (Nyon) or regular care (Solothurn and Vevey) conditions. This project was conducted over a 4-year period with research support from the Swiss National Science Foundation. A baseline assessment was made in late 1977 and early 1978 by stratified random sampling and examination of 2,000 persons aged 16 to 69 in each community. With attrition of approximately 30 percent, this sample was resurveyed at the end of 1980, at which time another independent sample was drawn and surveyed. A questionnaire was used to determine smoking behavior, and plasma thiocyanate was measured on a subsample of respondents. Other health-related factors such as blood pressure, lipid fractions, exercise tolerance, and psychosocial adjustment were also measured.

The community interventions were conducted over 2.5 years in Nyon, with guiding principles of "active local participation" and "integration into existing local health and social services." The central feature was the establishment of a Citizen Health Action Committee in each of the two towns, with a coordinator assigned to guide local planning and implementation. Media and community organizations were combined to promote a variety of programs in each location, including classes, self-help groups, and meetings to discuss topics such as environmental regulation via public non-smoking areas.

The results of this study are moderately encouraging. Within the sample population surveyed at baseline and followup, 26 percent of the regular smokers in the intervention communities reported cessation. In the control areas, 18 percent of the corresponding group reported cessation. The investigators also report effects on other cardiovascular disease risk factors, although plasma cholesterol reductions were significant only for women in the German-speaking region. A cost-benefit estimation model has been applied to the data and results indicate a twofold cost-benefit ratio. The use of indepen-

dent surveys and the random assignment of communities represent significant methodological strengths as compared with the Stanford and Australian studies. However, the rural communities in this study were very small, and only four were included. The final report has been presented to formal decisionmakers to determine whether broader national efforts are warranted.

The North Karelia Project

The best documented long-term community study is being conducted in Finland by Puska and colleagues (Puska et al. 1979, 1981, 1983a; Puska and Koskela 1983; McAlister et al. 1982). Also beginning in 1972 and continuing to the present, the research is comparing changes in cardiovascular disease risk factors in two neighboring counties of eastern Finland, Kuopio and North Karelia. Both are large rural areas with numerous small farming, lumber, or mining communities and a single major town. North Karelia is representative of eastern Finland as a whole in having one of the world's highest rates of cardiovascular disease (Pyörälä 1974; World Health Organization 1975). Financial support for the intervention came from the Finnish Ministry of Health, following a formal request from leaders in North Karelia for help in reducing the high mortality and morbidity levels. Research funds were awarded by the Academy of Finland. The neighboring county of Kuopio was selected as a reference or control location. In North Karelia, a broad program was implemented to provide new services, education, and training through community health centers, the mass media, and a variety of community organizations. During the second 5 years of the project, media programs were carried out on a national level, with special organizing and support for activities in North Karelia.

In both counties, independent samples of households were drawn in 1972, 1977, and 1982, with approximately 5,000 persons aged 25 to 59 in 1972 sampled in each area in the first two surveys and about 4,000 aged 25 to 64 sampled in the 1982 measurement. Response rates were generally excellent, and nearly 90 percent of the sample participated by attending local survey centers in the spring of each of the survey years (1972, 1977, 1982). Self-reported cigarette-smoking behavior was measured in all three surveys. In the 1977 survey, serum thiocyanate values were estimated for a subsample, and in the 1982 survey, for all participants. For the 1977 sample, there was 99 percent agreement in smoking status (smoker/nonsmoker), and when classified by intervals of 5 or 10 cigarettes, the agreement between results was 93 and 97 percent, respectively (Puska et al. 1979). The age-adjusted partial correlation between daily reported number of cigarettes and serum thiocyanate in 1982 was approximately 0.7 among men and women in both areas. In the years when the larger surveys were not conducted, smaller samples (1,200 to

3,500) were selected yearly for a postal survey of North Karelia. Together, these measurements provide a comparative view of trends over 10 years in the populations of both counties and a year-to-year picture of the changes in North Karelia.

The program of service, education, and training was very broad in scope. Initially, an intensive educational campaign was conducted for reduction of cigarette smoking with cooperation from the news media. Physicians and public health nurses staffing community health centers were provided special training and were encouraged to recommend cessation to all patients visiting the centers. Tens of thousands of leaflets and posters were distributed to encourage nonsmoking. With assistance from Heart Association volunteers in each small community, informal restrictions on smoking and point-of-purchase advertising were adopted. During 1976 and 1977, these measures became part of a package of national legislation that increased cigarette tax revenue, directed health services to provide information services, limited public smoking, and banned tobacco advertising.

During the second 5-year period, an effort was made to provide nationwide applications, while maintaining intensive community work in North Karelia. A series of programs was broadcast nationally on television to demonstrate how "average" people stop smoking (Puska et al. 1981). In association with these broadcasts, special organizing campaigns were conducted in North Karelia to increase social support for people attempting to quit. These activities occurred in the winters of 1978, 1979, 1980, and 1982 and were seen nationally by a majority of the population, with higher viewership in North Karelia. During the first broadcast series, an effort was made to encourage the formation of informal volunteer-led self-help groups to view the broadcasts together. Very few volunteers succeeded in establishing groups, however, and focus in subsequent years has been on training volunteers to provide even less formal cueing, reinforcement, and support in their incidental, day-to-day contacts with cigarette smokers (Puska et al. 1981).

The results to date (Puska and Koskela 1983) are presented in Table 1. Over the 10-year period, self-reported numbers of cigarettes smoked per day fell by more than one-third among men in North Karelia. In the control or reference area, a less than 10 percent reduction was observed. Changes in prevalence of smoking account for most of this difference. No evidence of an effect occurred among women, with rates of smoking going up in both areas. In Figure 2, the year-to-year data for 25- to 29-year-old men and women in North Karelia show an interesting pattern, with the sharpest declines among men associated with the first year of work and with the television broadcasts and associated activities in 1978 to 1980 and in 1982. Since 1978, when new antismoking laws were passed, the

proportion of male smokers aged 15 to 64 has changed from 44 to 31 percent in North Karelia, and from 39 to 35 percent in the rest of the country, a difference of 9 percent in absolute rates of change over that 4-year period. Although the effect of changes in smoking cannot be separated from the effects of new hypertension services and other measures to prevent cardiovascular disease, there is some early indication that mortality rates may have been influenced by the program: a 24 percent decline in cardiovascular deaths has been observed in North Karelia, compared with a 12 percent decline nationally in Finland (Puska et al. 1983a, b).

The North Karelia Project has received much attention, and various points of controversy have been widely discussed. The methodology of the study does not compare with that achieved in controlled clinical trials, but it may have been the optimal design that was feasible in the circumstances. Puska and his colleagues point out that "it is easy to say that the North Karelia Project was successful because of the unique historical background and because the conditions in North Karelia were favorable for the program. However, at the planning stage, great concern was expressed because the area was rural, of low socioeconomic status with high unemployment, and so forth." Because a large number of independent units were not randomly assigned to experimental and control conditions, the Finnish study cannot be taken as a conclusive test of the effects of community programs, but it does provide a promising illustration and evaluation of what can be achieved through broad and vigorous intervention to reduce smoking behavior. Its major strengths are the relatively large number of different communities that were studied and the 10-year followup interval.

Other Large-Scale Studies

There have been a number of other large-scale controlled studies, single and multifactor clinical trials, and worksite trials that provide a context for the consideration of the community-level intervention studies described above. These studies were discussed in the 1983 Report of the Surgeon General *The Health Consequences of Smoking* and include the London Civil Servants Smoking Trial (Rose and Hamilton 1978; Rose et al. 1980, 1982), the Göteborg (Sweden) study (Werko 1979; Wilhelmsen 1981; Wilhelmsen et al. 1972), the Oslo (Norway) study (Hjermann et al. 1981; Holme et al. 1981), the World Health Organization European Collaborative Trials (WHO European Collaborative Group 1974; Kornitzer et al. 1980a, b) and the Multiple Risk Factor Intervention Trial (MRFIT) (Hughes et al. 1981; MRFIT 1982). In the sole American study (MRFIT), 12,866 men, 35 to 57 years old and at high risk for coronary heart disease (CHD), were entered into a randomized clinical trial designed to test the effect of a multifactor intervention program on CHD morbidity and

TABLE 1.—Mean amount of reported daily smoking (\pm SD) in North Karelia and the reference area, in independent baseline (1972) and 5-year (1977) and 10-year (1982) followup survey samples, by sex and age

Sex and age (years)	North Karelia			Reference area			Net difference, percentage ¹	
	1972	1977	1982	1972	1977	1982	1972-1977	1972-1982
Men								
30-39	10.6 ± 11.7	9.0 ± 12.5	7.2 ± 10.7	8.5 ± 11.0	9.0 ± 11.9	8.6 ± 11.5	16	33
40-49	10.2 ± 11.2	8.5 ± 11.6	7.0 ± 10.3	9.0 ± 10.7	8.6 ± 11.4	8.0 ± 11.7	10	21
50-59	9.0 ± 10.7	7.9 ± 11.5	5.7 ± 9.7	7.7 ± 9.9	7.7 ± 10.5	6.5 ± 9.6	16	23
Total	10.0 ± 11.3	8.5 ± 11.9	6.6 ± 10.2	8.5 ± 10.6	8.5 ± 11.4	7.8 ± 11.1	13	28
Women								
30-39	1.4 ± 4.2	1.6 ± 5.1	2.6 ± 5.8	1.5 ± 4.5	2.0 ± 4.8	2.8 ± 6.2	15	2
40-49	1.2 ± 4.0	1.1 ± 4.0	1.5 ± 4.4	1.0 ± 3.2	1.2 ± 5.0	1.7 ± 4.9	23	36
50-59	0.7 ± 3.2	0.7 ± 3.4	0.9 ± 3.6	1.0 ± 3.6	0.8 ± 3.2	1.2 ± 4.0	43	41
Total	1.1 ± 3.8	1.1 ± 4.2	1.7 ± 4.7	1.2 ± 3.8	1.3 ± 4.4	1.9 ± 5.1	8	14
Four-way ANOVA ²		1972-1977	1972-1982	ANOVA for linear trend 1972, 1977, 1982		North Karelia	Reference area	
Area		p<0.05	n.s.	Men		p<0.001	n.s.	
Time		n.s.	p<0.001	Women		p<0.001	p<0.001	
Area-time		p<0.01	p<0.001					
Area-time-sex		p<0.05	p<0.001					

¹ (North Karelia, 1982/1977-1972) - (Reference area, 1982/1977-1972).

² ANOVA = Analysis of variance.

SOURCE: Puska and Koskela (1983).

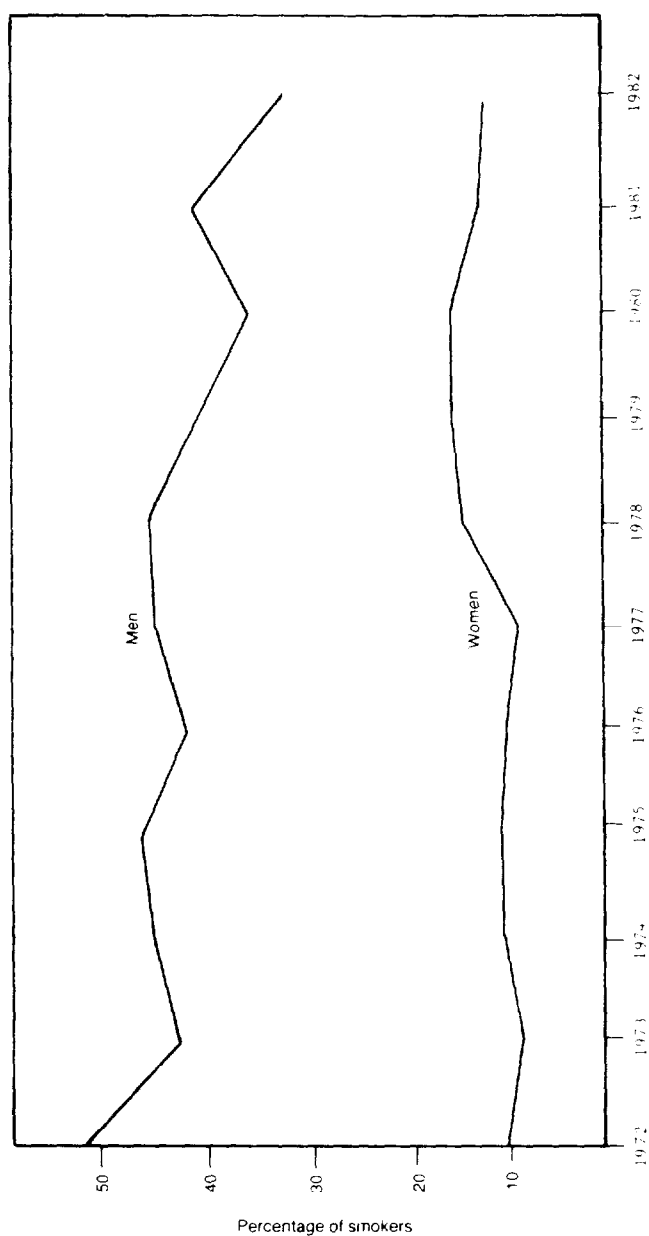


FIGURE 2.—Prevalence of smoking among men and women, aged 25–29, North Karelia, 1972–1982

SOURCE: Puska and Koskela (1983).

mortality. They were followed for an average of 7 years. At intake,

TABLE 2.—Results of community studies compared with other large-scale studies

Study	Years of study	Net percent reduction in smoking ¹	Strengths	Weaknesses
Stanford Three-Community study	3	15-20	Matched communities	Panel study only
Australian North Coast study	3	15	Independent samples	Problems with comparability of groups
Swiss National Research program	3	8	Randomization, independent samples	Small size and number of study sites
North Karelia project	10	25 ²	Numerous communities, independent samples	Nonrandom assignment
Other large-scale studies ³	2-10	5-25	Internal validity	External validity

¹ Difference between percent reduction in proportion of smokers in the maximum intervention versus control conditions.

² Difference between percent reduction in the mean number of cigarettes smoked per day among men.

³ Clinical and work-site trials: the London Civil Servants Smoking Trial, the Goteborg study, the Oslo study, the WHO Collaborative Trial, and the Multiple Risk Factor Intervention Trial.

the self-reported prevalence of smoking was 64 percent. The 6,428 men randomized into the Special Intervention (SI) group received intensive group sessions, personal instruction, and other followup to encourage and support cessation of smoking, as well as intensive assistance to alter other CHD risk factors. There were 6,438 men in the group randomly assigned to Usual Care (UC). At 6-year followup, self-reported cessation rates were 43 percent in the SI group and 25 percent in the UC group. Thiocyanate analyses showed a necessity for small adjustments in these figures to 42 percent and 24 percent, respectively, a statistically significant difference ($p < 0.01$). Comparison of the results from the four community studies with those from the large-scale studies, as shown in Table 2, indicates distinct similarities. The individual studies each have somewhat different weaknesses, but all indicate that absolute reductions in smoking prevalence in intervention communities are about 12 percent greater than reductions in comparison communities.

Several ambitious community studies of cardiovascular disease prevention are currently in progress with support from the National Heart, Lung, and Blood Institute, but no additional data on community-level intervention are available. At Stanford University, a large study of two intervention and three control towns with several hundred thousand residents has been in progress since 1978 and is projected to continue for at least 10 years (Farquhar 1978). A

similar study, with three matched pairs of variously-sized towns and cities, has been in progress in Minnesota since 1979 (Blackburn et al., in press; Blackburn, in press; Blackburn and Pechacek, in press). A smaller study of one Rhode Island town and one town in a neighboring State began in 1980 (Lasater 1983). Because it has become clear that community studies are the most natural and cost-effective method for testing new public health services to reduce chronic disease (Farquhar 1978; Puska et al. 1983a, b), more of these efforts may be useful, particularly if costs can be reduced and, where possible, absorbed into existing services.

Related Studies of Cessation

A number of recent efforts have increased understanding of and confidence in the methods employed in large-scale community studies. Research on methods of stimulating interpersonal support for mass media programming is particularly relevant (Colletti and Brownell 1982). In quasi-experimental studies, McAlister et al. (1980) and Puska et al. (1981) have reported methods for facilitating the effectiveness of televised smoking cessation classes in Finland. Formal self-help groups appear difficult to organize, but reorganization of less formal social reinforcement in natural interaction settings appears feasible and effective. Related studies of television and other media-based methods are described by Danaher et al. (1983), Best (1980), Leathar (1981), and others. Dubren (1977a, b), Brengelmann (1976), and the American Cancer Society (1981) found that effects of media programs may be enhanced if a telephone hotline is offered. Flay et al. (1983b) used a school-based, family-oriented prevention program that included a five-segment television component to be aired the following week to encourage participation of cigarette-smoking parents. Overall, parents of students in experimental groups were over three times more likely to view the cessation segment than parents of control students, with similar differences observed for the proportions of successful parental attempts to quit. Within the experimental groups, teacher training had a significant effect ($p < .01$) on raising participation rates by parents of program students. Considering only homes with smokers, 51 percent of the students with trained teachers reported that at least one cigarette smoking adult viewed one or more cessation segments, compared with 37 percent of students with untrained teachers. Furthermore, 38 percent of parents with trained teachers attempted to quit smoking, compared with 24 percent of parents of students with untrained teachers ($p < .001$). At 1-year followup, the cessation rates in the two groups were 19 and 13 percent, respectively, according to children's reports of parental behavior. The validity of the indicators of adult smoking behavior is at issue; student reports could contain bias, which will be estimated in further

analyses. Nevertheless, these results suggest that children can enhance the effectiveness of a media program in encouraging parents to stop smoking, and that organized social reinforcement is important in mass media smoking cessation programming (Flay et al. 1983b). More research is needed on these and other methods of large-scale social reinforcement and support for cessation of smoking.

Some attention has been given to environmental changes that might contribute to the cessation of cigarette smoking. Evidence indicates that smoking can be regulated by counteradvertising, restrictions on advertising, warning labels, and symbolic or governmental actions such as the Surgeon General's Report of 1964 (Warner 1977). Complete prohibition of smoking is not an acceptable alternative, but restrictions on smoking locations may be helpful for people attempting to quit voluntarily (Horwitz et al. 1982). Taxation of cigarettes has provided an effective deterrent in some population groups, particularly among younger men (Lewit et al. 1981). In Finland, cigarette taxes have been increased and a portion (0.5 percent) of the funds are dedicated to support services to reduce the prevalence of smoking (Puska and Koskela 1983). Similarly, integrated environmental and educational interventions may be useful in further large-scale efforts.

Prevention Studies

Although evidence increasingly indicates that it is more cost effective to prevent the onset of smoking among young people than to change the dependent behavior of adults, smoking prevention has received far less attention than cessation in controlled community research. This can be attributed to the complex processes involved in the onset of smoking (e.g., Evans 1976; Leventhal and Cleary 1980), to the extended timespan required for proper evaluation of prevention studies, and to the overall tendency of the health sciences to focus more on individual-level research than on primary prevention studies in which whole populations must be followed. Research on the prevention of smoking onset was considered in detail in the 1982 Report of the Surgeon General *The Health Consequences of Smoking: Cancer* (USDHHS 1982), and only selective studies are reviewed herein. Although there are no currently available published reports on controlled community studies of smoking onset prevention in whole populations, a number of school-based studies have been conducted recently that involve large proportions of particular age-grade cohorts in discrete communities.

Stanford Study

In one such study McAlister et al. (1979, 1980b) assigned the 1978 seventh grade cohorts in two similar suburban California towns to control (receiving Usual Care health education) or to a special peer prevention program to deter the onset of smoking. The special intervention program consisted of 7 classroom hours distributed over the school year in which 15- to 17-year-old peer leaders led Socratic dialogues, role plays, and simple contests to reinforce smoking avoidance behavior among 12-year-old students and to promote the social desirability of nonsmoking. Role plays and simple contests were used to help students learn assertive ways of declining offers to smoke, emphasizing counterarguments to the kinds of perceived peer social pressures that may be associated with the onset of smoking (McAlister et al. 1979). Several followup sessions were conducted when the study cohort reached the eighth grade.

At baseline and three followup points, students in the control and the environmental groups provided anonymous self-reports of smoking through classroom surveys. Participation rates were close to 100 percent in all surveys, and the measures were supplemented by collecting samples of exhaled breath at followup. These repeated surveys provided good measures of smoking prevalence in the age-grades studied in the two similar suburban communities, and although attrition and replacement may have threatened inference, the findings in Figure 3 indicate that the special intervention may have had a preventive effect. Note that the dependent variable is the percentage of participants who reported smoking during the previous week. Definitions of smoking in adolescents often differ, making results difficult to compare. Over 2 years of initial followup, the rate of self-reported smoking onset diverged sharply in the two age-grade cohorts, and differences persisted over an additional year of followup (Telch et al. 1982).

The North Karelia Youth Project

Stemming from the North Karelian project described in an early section, a youth program was initiated in six rural communities in eastern Finland (Vartiainen et al. 1983). Two urban and two rural communities were assigned to intensive (direct contact with the experimenter) or countywide (teacher-led) intervention programs in North Karelia. Two matched communities were selected as controls in the neighboring province of Kuopio, and subjects were seventh grade students (average age of 13 years) in the autumn of 1978. From a population of 897 available students, nearly all participated in the baseline survey; 95 percent participated in a 2-year followup; and 88 percent participated in a second followup 30 months after the program began. The survey included measurements of self-reported smoking and related variables as well as serum thiocyanate levels.

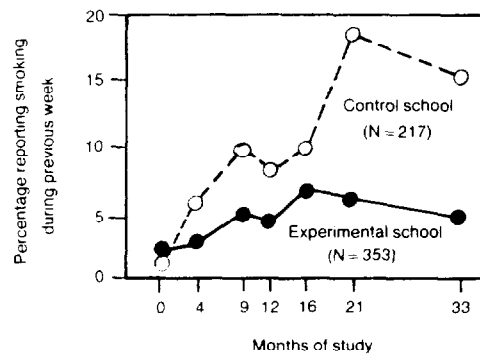


FIGURE 3.—Long-term effects of a peer group training course on smoking behavior of 13-year-old students

SOURCE: Telch et al. (1981).

The special intervention spanned the seventh and eighth grade years and included 10 hours of instruction in the intensive program and 5 hours in the countywide program. The methods were based on those employed by McAlister et al. (1980), as reported in the preceding study. Peer leaders, students 1 to 2 years older than the subjects, were the primary agents used to deliver the antismoking message. The program used role play and other active learning techniques to teach skills for resisting the social and psychological pressures to smoke and to reinforce negative attitudes toward smoking.

The results indicated a preventive effect from the special intervention, as shown in Figure 4. Among boys, the followup rates of smoking at least once a month were significantly lower in the four intervention schools (21 to 24 percent) than in the reference area communities (39 percent). Results for girls were less conclusive, but the overall difference between groups at followup was significant: a 17 percent rate of smoking at followup in intervention schools and a 24 percent rate in control schools. Analysis of the serum thiocyanate samples showed that 2 to 3 percent of the professed nonsmokers gave inaccurate self-reports, but the slight underreporting was greater in the control schools—indicating that inferences from the reported findings were not significantly threatened by self-report biases.

Other Prevention Studies

In a more rigorous study, Flay et al. (1983a) assigned 22 schools in Canada, some randomly, to receive special interventions or to serve as controls. The smoking prevention curriculum consisted of three major components, using the social psychological model delivered in

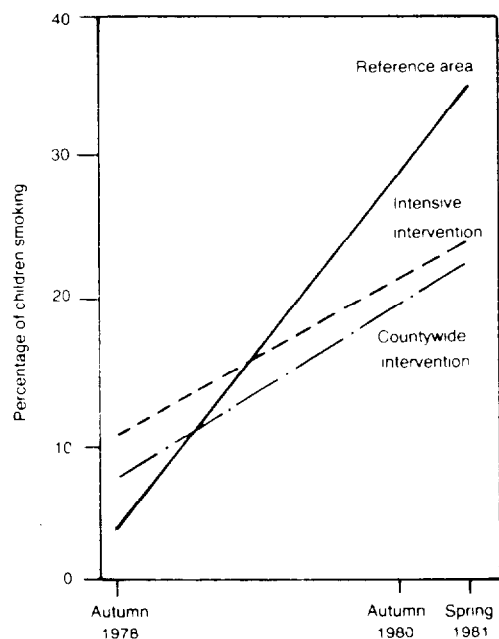


FIGURE 4.—Percentage of children who reported smoking at least once a month in baseline survey (1978) and two followup surveys (1980 and 1981)

SOURCE: Vartiainen et al. (1983).

six 1-hour weekly sessions during grade six. The social psychological model aims at developing future attitude and behavior changes and acquiring social skills, and involves eliciting information from children rather than providing it for them. The three components focused on smoking consequences and reasons for smoking, social influences promoting smoking, and decisionmaking and public commitment. Two booster sessions were delivered in both grades seven and eight. Short-term findings show a preventive effect, manifested in grade seven by an increased level of experimental smoking in the control group compared with the experimental group. In another study, Worden et al. (1983) tracked changes in smoking rates in two towns receiving a mass media campaign and a high-intensity program of adult communication skills related to adolescent smoking prevention. Over 1 year of followup, onset rates were markedly greater among a set of comparison towns receiving only the media campaign and some low-intensity community intervention.

McAlister (1983) randomly assigned members of five matched pairs of community and neighborhood schools to serve as controls or to receive an experimental prevention program. The study included students in the first year of secondary school (sixth or seventh grade) in 1979 in coastal and inland California towns and inner-city and suburban locations near Boston, Massachusetts. Over 2 school years of initial followup, sharply lower smoking onset rates were observed in some of the schools receiving the experimental programs. The findings are difficult to interpret and suggest that variability among highly diverse community age-grade cohorts, inconsistent implementation, and other related factors threaten inferences that may be drawn from studies of relatively small numbers of unique age-grade cohorts. Preventive effects on smoking onset have been reported by other investigators in Houston (Evans 1976), Minnesota (Hurd et al. 1980), New York (Botvin et al. 1980), and elsewhere; they were reviewed extensively in the 1982 Report of the Surgeon General *The Health Consequences of Smoking* (USDHHS 1982). These studies have tended to show positive results for the nontraditional health education methods, particularly those using peer teaching and role plays of saying no or resisting social pressures toward smoking. Currently, large-scale research on the prevention of smoking is in progress in the community studies of cardiovascular disease prevention that were cited in a previous section, as well as in other research centers in the United States and abroad. Internationally, Sweden has declared the creation of a "Smoke-Free Generation," and other countries have taken various steps to deter the onset of smoking (Wake et al. 1982).

Although studies were not sufficient to confirm the hypothesis, it is probable that young people not strongly dependent on tobacco are most sensitive to the various "environmental" policy options for smoking reduction. For example, the price elasticity of decisions to smoke regularly (smoking status) is -1.4 for males aged 20 to 25, but lower for older men (Lewit et al. 1981). This indicates that a 9 percent increase in the price of cigarettes might yield a 15 percent decrease in the proportion of male smokers in the younger age group. Environmental changes related to the marketing, price, or availability of cigarettes tend to be implemented in whole States or nations and are not amenable to controlled demonstration research. However, as local authorities play an increasing role in various matters, opportunities for innovative community level research may be available.

Methodological Issues

In view of the high costs of clinical trials, such as those incurred by the Multiple Risk Factor Intervention Trial, a strong argument can

be made for the cost effectiveness and generalizability of community studies of chronic disease prevention (e.g., Farquhar 1978). However, there are methodological problems with the community studies that deserve careful consideration. In order to ensure strict adherence to assumptions of the statistical theories supporting experimental inference, independent units of observation must be sampled. Because the behavior and disease rates of people within a community are obviously not independent, the data from geographic units must be aggregated at various levels, such as family, neighborhood, community, and region. Thus, for example, smoking rates in three communities assigned to three different experimental conditions must be treated as three discrete observations, but having only one observation per condition does not permit use of traditional statistical procedures for hypothesis testing. By assigning more than one community to each condition, between-community variance can be estimated to provide more valid tests of program effect. As the statistical theory guiding community studies becomes more developed (Flay and Cook 1981), future research may be expected to involve more sites, with fewer cases sampled in each site.

Another problem concerns the comparability of groups. Unless a large number of communities are randomly assigned to conditions, the strict methodologist can identify obvious threats to experimental validity. For example, it might be natural to expect a bias toward the application of experimental programs in settings favorable to the adoption of innovation, while using "less interested" communities for the control group. This inevitably raises questions about the comparability of communities with regard to socioeconomic status, cosmopolitan features, or other hard-to-measure social characteristics. If the experimental group has a favorable predisposition at baseline, inferences about changes in health-related variables are severely threatened. When a high degree of demographic similarity between communities can be demonstrated, confidence in inferential statistics is enhanced. If possible, the communities to be compared should be assigned randomly to experimental groups or to control groups.

Problems with comparability are also introduced by the possibilities of experimental contamination or confounding effects of competing experimental programs. This issue must be thoroughly analyzed with respect to the North Karelia Project, where it appears that program results for dietary change and control of hypertension have been diluted by program spillover and the establishment of new health services in the reference (control) area.

Related to the issue of comparability of groups within a study is the problem of generalization to broader populations. For example, some groups that fall into the lower socioeconomic strata have not followed the general population trend toward smoking cessation and

may also be at increased risk for smoking-related disease from concurrent industrial exposures. Results of trials involving such populations (WHO European Collaborative Trials) should be examined for overall outcome as well as evaluation of programmatic elements wherever possible. Differential effectiveness of intervention techniques with varying populations remains to be established.

Another methodological question is raised by studies that rely primarily on self-reports that may be biased by intervention programs (Evans et al. 1977; Benfari et al. 1977; Pechacek et al., in press). Physiological indicators of cigarette smoking are expensive in studies involving large numbers of individual measurements. Most researchers take physiological measurements from a subsample of the group providing self-reports. If there is no evidence of self-report bias between groups, experimental comparisons can be based on the self-report data. However, the usefulness of this procedure depends upon the statistical power of the test comparing relationships between self-reports and physiological measures in the different experimental groups. Tests based on very small subsamples will almost certainly show no statistically significant evidence of self-report bias, but only because they lack the statistical power to detect the relatively small differences that might confound inference. Numerous other methodological points are pertinent to the review of community studies. For example, cohort studies that track individuals over time may be much less generalizable than those that involve repeated independent surveys, but are critical for studying development of certain behaviors, such as smoking onset. A great need exists, therefore, for more focused awareness on the various methodological concerns that limit the interpretation of community studies.

Directions for Future Studies

There is a clear need for further research on community-level intervention to reduce smoking. The challenge is to develop relatively inexpensive methods that can be easily implemented on a large-scale basis. This will involve refinements in three broad activity categories: (1) education and instruction related to smoking, smoking cessation, and smoking prevention; (2) social reinforcement in support for nonsmoking behavior; and (3) environmental changes related to cigarettes and cigarette smoking.

Education and instruction methods are needed to convey information, attitudes, and skills more effectively as they relate to the cessation and prevention of smoking. For example, as the factors contributing to the process of smoking cessation and prevention are identified (DiClemente and Prochaska 1982; McAlister 1983; Leventhal et al. 1980), they can be modeled via television or other forms of mass communication. Although the schools have an obvious role in

smoking prevention, the kinds of educational activities that appear to produce results are not easily adopted by traditional educators. Innovative education and training programs can be marketed to those willing to pay for therapeutic or consultative services related to smoking cessation and prevention, but less costly methods need to be developed for communitywide application. The establishment of smoking cessation programs within existing health services and the integration of chronic disease prevention with mental health promotion are also needed to effect broad-scale societal education and change.

Growing evidence indicates that the social reinforcement and support provided in formal therapies can be effectively evoked at far less expense by self-help groups and natural helping networks. In the North Karelia Project, community volunteers were taught to reinforce learning of smoking cessation skills from television (Puska et al. 1981). Children may also be powerful, natural sources of social reinforcement (Flay et al. 1983b). Related methods are being applied in other ongoing community studies to harness the influence of natural social networks for antismoking campaigns (Pechacek et al., in press). In addition to reinforcing specific behaviors and attitudes related to smoking prevention and cessation, social environments can give more general support and assistance to people trying to cope with stress, strain, and conflict. Given the relationship between chronic smoking, stress, and alienation, it is reasonable to expect a positive effect from interventions that reduce stress, improve coping, and increase social support (Colletti and Brownell 1982).

Other community efforts are being made in noncontrolled contexts, as in the following examples. First, the American Cancer Society has introduced an "Adopt A Smoker" program to involve ex-smokers in the annual Great American Smokeout Day. Second, community physicians are being urged to increase the frequency and intensity of cessation advice given to smokers. Finally, the television and newspaper media have become involved in the antismoking campaign, frequently including programming and articles that feature behavioral scientists discussing smoking behavior and the techniques of quitting.

Options for environmental change and public policy are varied and complex (Farquhar et al. 1981). The outright prohibition of smoking is not feasible, but limited prohibitions on smoking in public and some private places can have desirable effects in shifting negative attitudes. Restrictions on marketing are difficult on a local level, but constraints on advertising or availability may have a powerful effect. As indicated in a previous section, new taxes or other broad environmental changes are more likely to affect young smokers among whom dependence is not firmly established. Thus, they may be expected to have cumulative, long-term effects on future smoking

rates. There is a role for research in clarifying optimal forms of restriction, but it has not been implemented, even in worksites where the effects of restrictions could be evaluated (Orleans and Shipley 1982).

Future studies must also develop an integrated model for combining cessation and prevention activities. Although the processes involved in the adoption of smoking are clearly different from those involved in its discontinuance, there are commonalities to be explored to find more efficient strategies for smoking reduction. The research of Flay et al. (1983a) is particularly promising in this regard. Any program that changes perceptions of social norms or other environmental factors may influence nonadoption or discontinuance of cigarette smoking, but effects will probably be greatest on young people not dependent on tobacco or on older age groups where the adverse health effects of smoking are already becoming apparent.

Summary and Conclusions

1. Community studies of smoking cessation and prevention are becoming an established paradigm for public health action research. Such studies emphasize large-scale delivery systems, such as the mass media, and include community organization programs seeking to stimulate interpersonal communication in ways that are feasible on a large-scale basis.
2. Although there are methodological limitations to nearly all communitywide studies, the results yield fairly consistent positive results, indicating that large-scale programs to reduce smoking can be effective in whole populations. Person-to-person communication appears to be a necessary part of a successful community program to reduce smoking.
3. Further research is needed, with both improved methodology and more emphasis on low socioeconomic status groups that have not yet shown population trends toward reduced smoking.
4. Several promising directions for research are clear, but the most important future trends will be toward the establishment of smoking reduction programs within existing health services, the combination of chronic disease prevention with mental health promotion via mass media and community intervention, and the development of social policy to establish integrated strategies for smoking cessation and prevention.

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